PATENT SPECIFICATION (11) 1 579 332

1 579 332

(21) Application No. 18888/76 (22) Filed 7 May 1976
(23) Complete Specification filed 25 July 1977
(44) Complete Specification published 19 Nov. 1980
(51) INT. CL.³ E21B 17/22
(52) Index at acceptance
B3C 1B6J 1B6N
(72) Inventor DENNIS DENMAN

(19)

(54) IMPROVEMENTS IN ROTARY DRILLING RODS

(71) We, MATTHIAS SPENCER & SONS LIMITED, a British Company, of Arley Street, Sheffield, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:–

This invention relates to rotary drilling rods such as are used in underground mineworkings in connection with roof bolting, shot firing and strata consolidation, the drilling rod having end formations for coupling to a drill bit and driving means, and a screw formation for the removal of debris.

Rotary drilling rods at present in use are normally either of diamond or turbine shape in cross-section, the choice of cross-section being determined by the conditions under which the drilling rod will be used. Thus, if rapid wear is likely to take place due to the abrasive nature of the mineral cut, a drilling rod of turbine section will be used to give a longer working life as this presents a larger surface area in contact with the side of the hole being drilled. On the other hand, if the material is not abrasive, a drilling rod of diamond section will be used as it will ensure the transmission of maximum power to the bit as the smaller surface area in contact with the side of the hole will minimise frictional losses.

The sections referred to above are generally satisfactory for use with hand-held drilling machines but the introduction of hydraulic drilling machines with power feed mechanisms has indicated the desirability of providing drilling rods of improved capability as compared with the turbine and diamond cross-section drilling rods at present in use. It is accordingly an object of the present invention to provide improvements in the configurations of drilling rods.

The invention resides in a rotary drilling rod with end formations for coupling to a drill bit and to driving means and with a screw formation for removal of debris, the screw formation comprising one or more helical ribs, the or each rib being in the form of a squat projection from a generally circular core and having a leading face smoothly merging with the core and an outer face decreasing in radial height from the leading face to a rearward face adjoining the core.

The leading face may be tangential to the core or it may curve from the core to lie radially at its outer extremity. The outer face may be of uniform curvature or it may have adjacent the leading face a circular portion concentric with the core, said portion merging with a curvate portion extending to the rearward face. Alternatively the outer face may be of stepped profile, the portion adjacent the leading face being of radial height greater than the remainder to form a land which in use engages the wall of a hole being drilled. Furthermore the outer face may be curved to merge smoothly with the rearward face.

The outer face decreasing in radial height from the leading face to the rearward face functionally forms with the rearward face a trailing face of progressively increasing radial clearance behind the outermost tip of the rib, the tip profile being of minimal circumferential extent for frictional engagement with the side of the hole being drilled or having a circular concentric profile or land as above stated to provide an outer edge portion of increased area for use in drilling minerals of an abrasive character.

There will normally be two flutes and the cross-sectional configurations in accordance with the invention will be such as to satisfy the following criteria:–

a) the cross-section is as strong as possible, consistent with leaving sufficient room for the clearance of cuttings, a cross-sectional area greater than half the hole area being attainable,

b) the shape of the flutes is such as to provide an efficient augering action to ensure removal of cuttings,

c) the area of the rod in rubbing contact with the side of the hole should be kept as low as possible consistent with providing satisfactory wear properties, and

d) the core of the rod should be capable of being machined to ensure a sufficiently strong connection for the bit and the chuck.

Although the drilling rods of the invention are primarily for use with rotary drilling rigs with power feed mechanisms, they can also be used for rotary percussive applications.

The invention will now be more fully described with reference to the accompanying drawings, in which:–

Figures 1, 2 and 3 are views of known rotary drilling rods, and

Figures 4 to 8 are cross-sectional views of drilling rods embodying the invention.

Figure 1 shows part of a drilling rod of diamond section, the diamond section appearing in Figure 2. Figure 3 shows an alternative turbine section, these sections being outlined in British Standards Specification BS 2593-1974. The drilling rod may be solid or tubular and has end formations for coupling at one end to a drill bit and at the other to a drive shaft, and with helical fluting providing a screw formation and usually extending the length of the rod between the end formations and serving to remove cuttings or debris. The diamond-section rod of Figures 1 and 2 is typically of 40 mm overall diameter and usually used with bits of 43 mm diameter, the minor axis of the diamond section being about 21 mm so that the section covers about 32% of the hole cross-sectional area. In the case of the diamond section, the fluting results in a cross-section exhibiting tapering ribs or fins projecting from a core portion so that the leading face is inclined forwardly from the tip in its sweeping movement in a bored hole. In the case of the turbine section there are parallel-sided ribs or fins with circumferential outer faces, the core being circular, and hence the leading face approaches the radial and so sweeps at an angle approaching a right angle. Thus the screw formation for removal of debris has a leading face sweeping at an angle not exceeding a right angle.

In pursuance of the present invention, as illustrated by the embodiments shown in Figures 4 to 8, a drilling rod is so fluted as to provide two helical ribs 1 each in the form of a squat projection from a generally circular core 2, that is, a projection which is short and wide, of radial height substantially less than the core radius and of circumferential width approaching or exceeding the core radius. Furthermore, the leading face 3 and preferably also the rearward face 4 merge smoothly with the core 2 and the outer face 5 decreases in radial height from the leading face 3 to the rearward face 4. Functionally the inwardly spiralling outer face and the rearward face together constitute the trailing face of the screw formation.

In Figure 4, the leading face 3 of the rib 1 is tangential to the core 2, which is of large diameter because of the small height of the rib. The outer face 5 has a small curvature and extends from the leading face to join the rearward face 4 at a lesser radius. The rearward face 4 is close to radial at the outer face and curves to merge with the core 2. In the variant shown in Figure 8, the rearward face 4 is tangential to the core.

In Figure 5, the rib 1 is even wider than in Figure 4, the leading face 3 curves from the core and reaches the radial at the tip thereby providing a sharp edge against the wall of a hole being drilled, and the rearward face 4 is flat and intersects the core circle.

In Figure 6, the forward end portion 5*a* of the outer face 5 is circumferential for surface contact with the wall of a hole being drilled.

In Figure 7, there is likewise a circumferential portion 5*a*, but it is raised proud of the main outer surface 5 which spirals inwardly to become the rearward face 4 joining the core 2.

WHAT WE CLAIM IS:–

1. A rotary drilling rod with end formations for coupling to a drill bit and to driving means and with a screw formation for removal of debris, the screw formation comprising one or more helical ribs, the or each rib being in the form of a squat projection from a generally circular core and having a leading face smoothly merging with the core and an outer face decreasing in radial height from the leading face to a rearward face adjoining the core.

2. A drilling rod according to claim 1, wherein the leading face is tangential to the core.

3. A drilling rod according to claim 1, wherein the leading face curves from the core to lie radially at its outer extremity.

4. A drilling rod according to any one of the preceding claims, wherein the outer face is of uniform curvature.

5. A drilling rod according to any one of the preceding claims, wherein the profile of the outer face has adjacent the leading face a circular portion concentric with the core, said portion merging with a curvate portion extending to the rearward face.

6. A drilling rod according to claim 1, 2, 3 or 4, wherein the outer face is of stepped profile, the portion adjacent the leading face being of radial height greater than the remainder to form a land.

7. A drilling rod according to claim 2,

wherein the rearward face is also tangential to the core.

8. A drilling rod according to any one of the preceding claims, wherein the outer face is curvate and merges smoothly with the rearward face.

9. A drilling rod substantially as herein described with reference to Figure 4, 5, 6, 7 or 8 of the accompanying drawings.

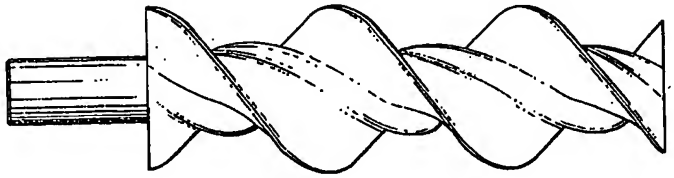
ARTHUR R. DAVIES
Chartered Patent Agents
27, Imperial Square,
Cheltenham.
–and–
115, High Holborn,
London, W.C.1.
Agents for the Applicants

Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1980. Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

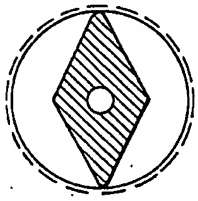
1579332 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

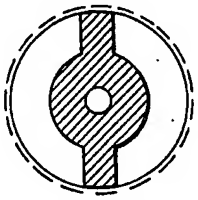
Sheet 1



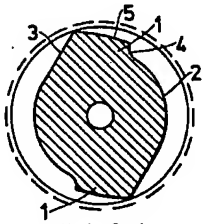
—FIG.1—



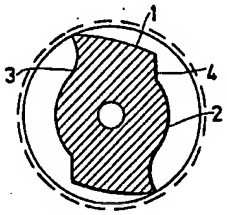
—FIG 2—



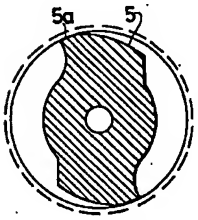
—FIG.3—



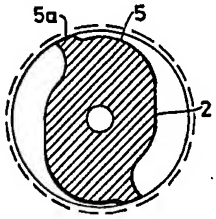
—FIG.4—



—FIG.5—



—FIG.6—

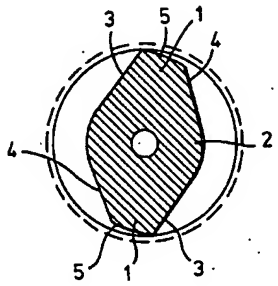


—FIG.7—

1579332 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 2



—FIG.8.—